

Application No.: 10/664,671

Docket No.: JCLA12230

$-\text{C}\equiv\text{C}-\text{HC}=\text{CH}-$, $-\text{CH}=\text{CH}-\text{C}\equiv\text{C}-$, $-\text{OCF}_2-$, or $-\text{CF}_2\text{O}-$, and a indicates an integer of from 1 to 20; Z^4 represents a single bond or α,ω -alkylene having from 1 to 4 carbon atoms, and any $-\text{CH}_2-$ of the alkylene may be substituted with $-\text{O}-$, $-\text{S}-$, $-\text{COO}-$ or $-\text{OCO}-$; m , n and q each independently indicates 0, 1 or 2, but $m+n+q\geq 1$; and
wherein when $m+n+q=1$, any $-\text{CH}_2-$ of the alkyl represented by R^1 is not substituted with $-\text{CO}-$ and Z^4 is a single bond; and
wherein when $m+n+q=1$, Z^4 is a single bond and A^4 represents 1,4-phenylene, Z^1 , Z^2 and Z^3 each is not a single bond.

2. (original) A compound as claimed in claim 1, in which R^5 in formula (1) is hydrogen.

3. (original) A compound as claimed in claim 2, in which R^2 and R^3 in formula (1) in claim 1 are hydrogen.

4. (original) A compound as claimed in claim 3, in which A^1 , A^2 , A^3 and A^4 in formula (1) in claim 1 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and any hydrogen in these rings may be substituted with halogen.

5. (original) A compound as claimed in claim 3, in which A^1 , A^2 , A^3 and A^4 in formula (1) in claim 1 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and any hydrogen in

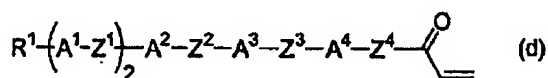
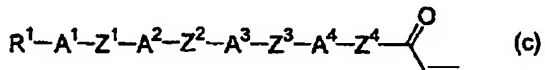
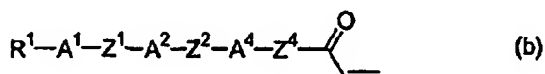
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these rings may be substituted with halogen; and Z^1 , Z^2 and Z^3 are independently any of a single bond, $-(CH_2)_a-$, $-O(CH_2)_a-$, $-(CH_2)_aO-$, $-O(CH_2)_aO-$, $-CH=CH-$, $-C\equiv C-$, $-COO-$, $-OCO-$, $-OCF_2-$, or $-CF_2O-$.

6. (original) A compound as claimed in claim 5, in which Z^4 in formula (1) in claim 1 is a single bond.

7. (currently amended) Any one compound of formulae (a) to (d):



wherein R^1 represents hydrogen, halogen, $-\text{CN}$, $-\text{CF}_3$, $-\text{CF}_2\text{H}$, $-\text{CFH}_2$, $-\text{OCF}_3$, $-\text{OCF}_2\text{H}$, $-\text{N}=\text{C}=\text{O}$, $-\text{N}=\text{C}=\text{S}$, or alkyl having from 1 to 20 carbon atoms, and any $-\text{CH}_2-$ of the alkyl may be substituted with $-\text{O}-$, $-\text{S}-$, $-\text{CO}-$, $-\text{COO}-$, $-\text{OCO}-$, $-\text{CH}=\text{CH}-$, $-\text{CF}=\text{CF}-$ or $-\text{C}\equiv\text{C}-$, and any hydrogen thereof may be substituted with halogen or $-\text{CN}$; A^1 , A^2 , A^3 and A^4 each independently represent 1,4-cyclohexylene, 1,4-cyclohexenylene, 1,4-phenylene, naphthalene-2,6-diyl, tetrahydronaphthalene-2,6-diyl, fluorene-2,7-diyl, bicyclo[2.2.2]octane-1,4-diyl or bicyclo[3.1.0]hexane-3,6-diyl, and in these rings, any

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$-\text{CH}_2-$ may be substituted with $-\text{O}-$, and any $-\text{CH}=\text{}$ may be substituted with $-\text{N}=\text{}$, and in these rings, any hydrogen may be substituted with halogen or alkyl having from 1 to 5 carbon atoms; Z^1 , Z^2 and Z^3 each independently represent a single bond, $-(\text{CH}_2)_a-$, $-\text{O}(\text{CH}_2)_a-$, $-(\text{CH}_2)_a\text{O}-$, $-\text{O}(\text{CH}_2)_a\text{O}-$, $-\text{CH}=\text{CH}-$, $-\text{C}\equiv\text{C}-$, $-\text{COO}-$, $-\text{OCO}-$, $-(\text{CF}_2)_2-$, $-\text{C}\equiv\text{C}-\text{COO}-$, $-\text{OCO}-\text{C}\equiv\text{C}-$, $-\text{CH}=\text{CH}-(\text{CH}_2)_2-$, $-(\text{CH}_2)_2-\text{CH}=\text{CH}-$, $-\text{CF}=\text{CF}-$, $-\text{C}\equiv\text{C}-\text{HC}=\text{CH}-$, $-\text{CH}=\text{CH}-\text{C}\equiv\text{C}-$, $-\text{OCF}_2-$ or $-\text{CF}_2\text{O}-$, and a indicates an integer of from 1 to 20; Z^4 represents a single bond or α,ω -alkylene having from 1 to 4 carbon atoms, and any $-\text{CH}_2-$ of the alkylene may be substituted with $-\text{O}-$, $-\text{S}-$, $-\text{COO}-$ or $-\text{OCO}-$, and

wherein in formula (a),

any $-\text{CH}_2-$ of the alkyl represented by R^1 is not substituted with $-\text{CO}-$; ~~and~~

Z^4 is a single bond; and

Z^1 is not a single bond when A^4 represents 1,4-phenylene.

8. (original) A compound as claimed in claim 7, in which R^1 in formulae (a) to (d) is hydrogen, halogen, $-\text{CN}$, $-\text{CF}_3$, $-\text{CF}_2\text{H}$, $-\text{CFH}_2$, $-\text{OCF}_3$, $-\text{OCF}_2\text{H}$, alkyl having from 1 to 10 carbon atoms, alkoxy having from 1 to 10 carbon atoms, alkoxyalkyl having from 2 to 10 carbon atoms, or alkenyl having from 2 to 10 carbon atoms; A^1 , A^2 , A^3 and A^4 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and in these rings, any hydrogen may be substituted with halogen; Z^1 , Z^2 and Z^3 are independently any of a single bond, $-(\text{CH}_2)_2-$, $-(\text{CH}_2)_4-$, $-\text{OCH}_2-$, $-\text{O}(\text{CH}_2)_3-$, $-\text{CH}_2\text{O}-$, $-(\text{CH}_2)_3\text{O}-$,

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$-\text{O}(\text{CH}_2)_2\text{O}-$, $-\text{CH}=\text{CH}-$, $-\text{C}\equiv\text{C}-$, $-\text{COO}-$, $-\text{OCO}-$, $-(\text{CF}_2)_2-$, $-\text{CF}=\text{CF}-$, $-\text{OCF}_2-$ or $-\text{CF}_2\text{O}-$; Z^4 is a single bond.

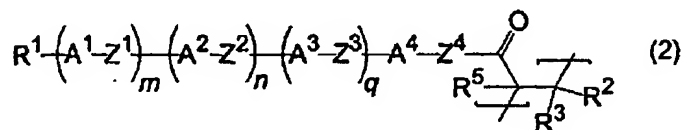
9. (previously presented) A liquid-crystal composition containing at least two polymerizable compounds, in which at least one polymerizable compound is the compound of claim 1.

10. (currently amended) A liquid-crystal composition ~~as claimed in claim 9~~, which contains at least two polymerizable compounds in which all the polymerizable compounds are the compounds of claim 1.

11. (currently amended) A liquid-crystal composition ~~as claimed in claim 9~~, which contains at least two polymerizable compounds that comprise at least one compound of claim 1 and at least one polymerizable compound except the compound.

12. (original) A liquid-crystal composition as claimed in claim 9, which additionally contains an optically-active compound.

13. (allowed) A polymer having a constitutional unit of formula (2):



wherein R^1 represents hydrogen, halogen, $-\text{CN}$, $-\text{CF}_3$, $-\text{CF}_2\text{H}$, $-\text{CFH}_2$, $-\text{OCF}_3$, $-\text{OCF}_2\text{H}$,

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$-\text{N}=\text{C}=\text{O}$, $-\text{N}=\text{C}=\text{S}$, or alkyl having from 1 to 20 carbon atoms, and any $-\text{CH}_2-$ of the alkyl may be substituted with $-\text{O}-$, $-\text{S}-$, $-\text{CO}-$, $-\text{COO}-$, $-\text{OCO}-$, $-\text{CH}=\text{CH}-$, $-\text{CF}=\text{CF}-$ or $-\text{C}\equiv\text{C}-$, and any hydrogen thereof may be substituted with halogen or $-\text{CN}$; R^2 , R^3 and R^5 each independently represent hydrogen or an alkyl having from 1 to 3 carbon atoms; A^1 , A^2 , A^3 and A^4 each independently represent 1,4-cyclohexylene, 1,4-cyclohexenylene, 1,4-phenylene, naphthalene-2,6-diyl, tetrahydronaphthalene-2,6-diyl, fluorene-2,7-diyl, bicyclo[2.2.2]octane-1,4-diyl or bicyclo[3.1.0]hexane-3,6-diyl, and in these rings, any $-\text{CH}_2-$ may be substituted with $-\text{O}-$, and any $-\text{CH}=-$ may be substituted with $-\text{N}=-$, and in these rings, any hydrogen may be substituted with halogen or alkyl having from 1 to 5 carbon atoms; Z^1 , Z^2 and Z^3 each independently represent a single bond, $-(\text{CH}_2)_a-$, $-\text{O}(\text{CH}_2)_a-$, $-(\text{CH}_2)_a\text{O}-$, $-\text{O}(\text{CH}_2)_a\text{O}-$, $-\text{CH}=\text{CH}-$, $-\text{C}\equiv\text{C}-$, $-\text{COO}-$, $-\text{OCO}-$, $-(\text{CF}_2)_2-$, $-\text{C}\equiv\text{C}-\text{COO}-$, $-\text{OCO}-\text{C}\equiv\text{C}-$, $-\text{CH}=\text{CH}-(\text{CH}_2)_2-$, $-(\text{CH}_2)_2-\text{CH}=\text{CH}-$, $-\text{CF}=\text{CF}-$, $-\text{C}=\text{C}-\text{HC}=\text{CH}-$, $-\text{CH}=\text{CH}-\text{C}\equiv\text{C}-$, $-\text{OCF}_2-$, or $-\text{CF}_2\text{O}-$, and a indicates an integer of from 1 to 20; Z^4 represents a single bond or α,ω -alkylene having from 1 to 4 carbon atoms, and any $-\text{CH}_2-$ of the alkylene may be substituted with $-\text{O}-$, $-\text{S}-$, $-\text{COO}-$ or $-\text{OCO}-$; and m , n and q each independently indicate 0, 1 or 2; and wherein when $m+n+q=1$, any $-\text{CH}_2-$ of the alkyl represented by R^1 is not substituted with $-\text{CO}-$ and Z^4 is a single bond.

14. (allowed) A polymer as claimed in claim 13, in which R^5 in formula (2) is hydrogen.

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15. (currently amended) A polymer as claimed in claim ~~14~~ 13, in which R^2 , R^3 and R^5 ~~in formula (2) in claim 13~~ are hydrogen.

16. (currently amended) A polymer as claimed in claim ~~15~~ 13, in which R^2 , R^3 and R^5 are hydrogen; A^1 , A^2 , A^3 and A^4 in formula (2) in claim 13 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and any hydrogen in these rings may be substituted with halogen.

17. (currently amended) A polymer as claimed in claim ~~15~~ 13, in which R^2 , R^3 and R^5 are hydrogen; A^1 , A^2 , A^3 and A^4 in formula (2) in claim 13 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and any hydrogen in these rings may be substituted with halogen; and Z^1 , Z^2 and Z^3 are independently any of a single bond, $-(CH_2)_a-$, $-O(CH_2)_a-$, $-(CH_2)_aO-$, $-O(CH_2)_aO-$, $-CH=CH-$, $-C\equiv C-$, $-COO-$, $-OCO-$, $-OCF_2-$, or $-CF_2O-$.

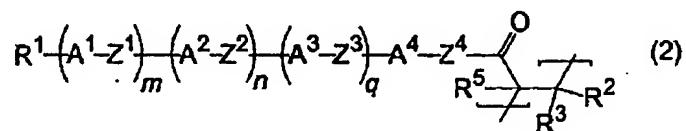
18. (currently amended) A polymer as claimed in claim ~~17~~ 13, in which R^2 , R^3 and R^5 are hydrogen; A^1 , A^2 , A^3 and A^4 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and any hydrogen in these rings may be substituted with halogen; Z^1 , Z^2 and Z^3 are independently any of a single bond, $-(CH_2)_a-$, $-O(CH_2)_a-$, $-(CH_2)_aO-$, $-O(CH_2)_aO-$, $-CH=CH-$, $-C\equiv C-$, $-COO-$, $-OCO-$, $-OCF_2-$, or $-CF_2O-$, and Z^4 in formula (2) in claim 13 is a single bond.

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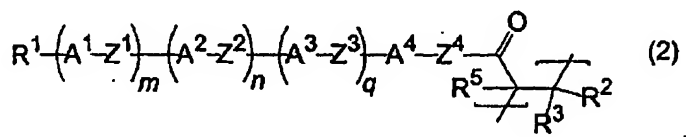
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19. (allowed) A polymer as claimed in claim 13, in which R^1 in formula (2) is hydrogen, halogen, $-\text{CN}$, $-\text{CF}_3$, $-\text{CF}_2\text{H}$, $-\text{CFH}_2$, $-\text{OCF}_3$, $-\text{OCF}_2\text{H}$, alkyl having from 1 to 10 carbon atoms, alkoxy having from 1 to 10 carbon atoms, alkoxyalkyl having from 2 to 10 carbon atoms, or alkenyl having from 2 to 10 carbon atoms; R^2 , R^3 and R^5 are hydrogen; A^1 , A^2 , A^3 and A^4 are independently any of 1,4-cyclohexylene or 1,4-phenylene, and in these rings, any hydrogen may be substituted with halogen; Z^1 , Z^2 and Z^3 are independently any of a single bond, $-(\text{CH}_2)_2-$, $-(\text{CH}_2)_4-$, $-\text{OCH}_2-$, $-\text{O}(\text{CH}_2)_3-$, $-\text{CH}_2\text{O}-$, $-(\text{CH}_2)_3\text{O}-$, $-\text{O}(\text{CH}_2)_2\text{O}-$, $-\text{CH}=\text{CH}-$, $-\text{C}\equiv\text{C}-$, $-\text{COO}-$, $-\text{OCO}-$, $-(\text{CF}_2)_2-$, $-\text{CF}=\text{CF}-$, $-\text{OCF}_2-$ or $-\text{CF}_2\text{O}-$; Z^4 is a single bond.

20. (currently amended) A polymer ~~as claimed in claim 13, which~~ that is obtained through homopolymerization of one compound of claim 1 and has a constitutional unit of formula (2):



21. (currently amended) A polymer ~~as claimed in claim 13, which~~ that is obtained from the liquid-crystal composition of claim 9 and has a constitutional unit of formula (2):



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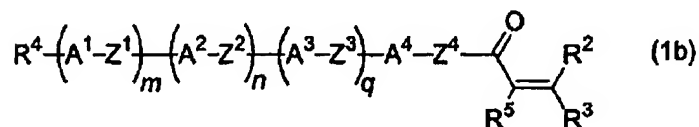
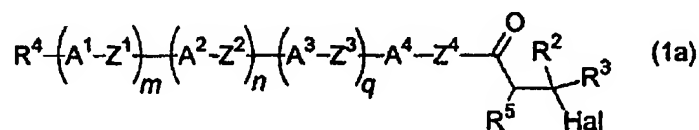
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22. (previously presented) An optically-anisotropic material of the polymer of claim 13.

23. (previously presented) A liquid-crystal display device, which contains the polymer of claim 13.

24. (original) A liquid-crystal display device, which contains the optically-anisotropic material of claim 22.

25. (allowed) A method for producing a vinyl ketone compound of formula (1b), which comprises reacting one molar equivalent of a compound of formula (1a) with from 1 to 10 molar equivalents of a Lewis acid at -70°C to 200°C, followed by dehydrohalogenating the resulting compound:



wherein R^4 represents hydrogen, halogen, -OH, -CN, -CF₃, -CF₂H, -CFH₂, -OCF₃, -OCF₂H, -N=C=O, -N=C=S, or alkyl having from 1 to 20 carbon atoms, and any -CH₂- of the alkyl may be substituted with -O-, -S-, -CO-, -COO-, -OCO-, -CH=CH-, -CF=CF- or -C≡C-, and any hydrogen thereof may be substituted with halogen or -CN; R^2 , R^3

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and R⁵ each independently represent hydrogen or an alkyl having from 1 to 3 carbon atoms; A¹, A², A³ and A⁴ each independently represent 1,4-cyclohexylene, 1,4-cyclohexenylene, 1,4-phenylene, naphthalene-2,6-diyl, tetrahydronaphthalene-2,6-diyl, fluorene-2,7-diyl, bicyclo[2.2.2]octane-1,4-diyl or bicyclo[3.1.0]hexane-3,6-diyl, and in these rings, any -CH₂- may be substituted with -O-, and any -CH= may be substituted with -N=, and in these rings, any hydrogen may be substituted with halogen or alkyl having from 1 to 5 carbon atoms; Z¹, Z² and Z³ each independently represent a single bond, -(CH₂)_a-, -O(CH₂)_a-, -(CH₂)_aO-, -O(CH₂)_aO-, -CH=CH-, -C≡C-, -COO-, -OCO-, -(CF₂)₂-, -C≡C-COO-, -OCO-C≡C-, -CH=CH-(CH₂)₂-, -(CH₂)₂-CH=CH-, -CF=CF-, -C≡C-HC=CH-, -CH=CH-C≡C-, -OCF₂- or -CF₂O-, and a indicates an integer of from 1 to 20; Z⁴ represents a single bond or α,ω-alkylene having from 1 to 4 carbon atoms, and any -CH₂- of the alkylene may be substituted with -O-, -S-, -COO- or -OCO-; m, n and q each independently indicate 0, 1 or 2; Hal represents chlorine, bromine or iodine.